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SCIENCE NEWS LETTER

THE WEEKLY SUMMARY OF CURRENT SCIENCE • OCTOBER 6, 1945

TECHNOLOGY DEP

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DETROIT

Axolotl

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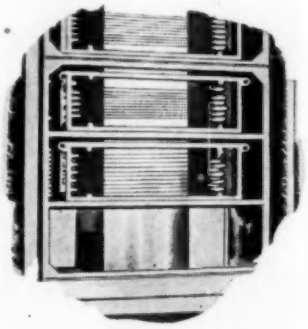
A SCIENCE SERVICE PUBLICATION

he started something that will never stop

25 YEARS AGO a Westinghouse research engineer started something that was destined to have a profound effect upon the lives of all of us . . . and upon generations yet unborn. That *something* was *radio broadcasting.*

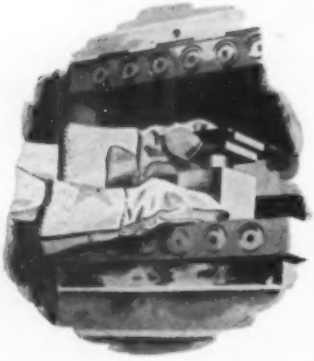
Radio broadcasting was born

on November 2, 1920, when the Presidential Election returns were broadcast from the tiny radio station, KDKA – built by Dr. Frank Conrad at the Westinghouse plant in East Pittsburgh, Pa. It was the first *scheduled radio broadcast* in history . . . the forerunner of a world-wide network that would eventually carry enlightenment and entertainment to the far corners of the earth.



Another "first"

by Westinghouse was the use of radio waves to fuse a mirror-like finish on dull electrolytic tin plate. High-frequency induction heating now helps make *one pound* of war-scarce tin do the work of *three.*

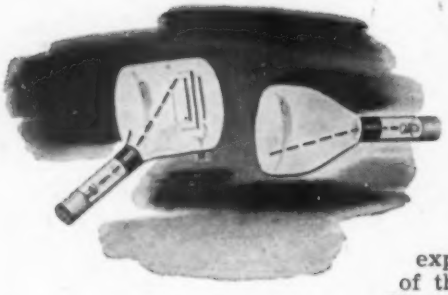


Dielectric death

. . . administered to weevils in grain elevators . . . is another example of the ingenuity of Westinghouse high-frequency engineers. Westinghouse dielectric heating equipment is today speeding the bonding of plywood and curing of plastics and synthetic rubber.

Frequency modulation

was pioneered by Westinghouse scientists as far back as 1920. At that early time they experimented with high frequencies that led the way to the static-free, crystal-clear FM we know today.



Television

has become a reality because of the genius of Westinghouse micro-wave experts, who developed the forerunner of the Iconoscope in 1923 and the Kinescope in 1929. These devices banished forever cumbersome scanning discs.

Research in microwaves

never stops at Westinghouse. Research, begun 20 years ago, resulted in the key electronic tube for the *first* long-range Radar equipment. Other secret devices, born of war in the Westinghouse Research Laboratories, will contribute to a better, brighter peacetime world.

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Tune in: JOHN CHARLES THOMAS—Sunday, 2:30 pm, EST, NBC ● TED MALONE—Monday through Friday, 11:45 am, EST, American Network

CHEMISTRY

Can Kill 300,000 Rats

ANTU, powerful poison, developed from taste tests in psychology laboratory. War restrictions lifted, will soon be available. Not dangerous to humans.

➤ ANTU, a rat poison so powerful that one pound could kill 300,000 rats but which is not dangerous to humans, will soon be available to the public.

Discovered through taste tests in a psychology laboratory, ANTU has been a closely guarded secret during the war. First inkling that security restrictions had been lifted came with publication in the U. S. Public Health Service's *Public Health Reports* of a scientific study by Drs. Wm. T. McClosky, M. I. Smith and R. D. Lillie of the National Institute of Health.

Credit for the discovery of ANTU as a rat poison, however, goes to Dr. Curt P. Richter, of the Phipps Psychiatric Clinic at Johns Hopkins Hospital in Baltimore.

The word ANTU is made of the initial letters of the rat poison's chemical name, alpha-naphthyl thiourea. It is a fine gray powder with very little odor or taste. Compared to other rat poisons, ANTU turned out to be twice as poisonous as thallium sulfate and more than 100 times as poisonous as arsenic trioxide and fortified red squill on the basis of the sizes of the killing doses of each.

ANTU has two remarkable features. 1. It acts almost exclusively on rats, leaving humans and most other species unharmed. 2. It kills rats in an unusual way, causing a dropsy of the lungs so great that the animals are drowned in this fluid from their own bodies. It is the only substance known to produce an edema, or dropsy, that is limited to the lungs.

For rat eradication, ANTU can be used mixed with finely ground corn or wheat; as a spray or dust on fruit or vegetables such as cut-up apples, sweet potatoes, tomatoes, and the like; as a dust, either pure or mixed with flour, on floors and runways; as a dust on the surface of water where rats are likely to drink; or blown as dust into rat holes and burrows with standard dust pumps used in rat eradication.

Large scale field trials in Baltimore showed that it can produce results very rapidly when properly used. In an emergency, such as an epidemic of rat-borne disease like typhus or plague, probably 95% or more of the rat population of a city could be wiped out in 24 to 48 hours, providing a supply of material and trained personnel were available.

The Baltimore trials also showed that ANTU must be used systematically to be effective. Rats that do not get enough of the poison to be killed outright grow wary about sampling ANTU-poisoned bait another time. The bait must carry enough poison and enough of it must be used to get every rat in the region at one time.

Dr. Richter recommends the city block as the smallest unit for rat eradication with ANTU, because, while rats move from yard to yard within a block, they rarely cross one of the streets to the next block. Complete coverage, with every rat hole, burrow and runway in every building, cellar and yard within the block containing adequate amounts of ANTU, is essential to success. So also is the cooperation of householders in the area. A preliminary clean-up of the block or area and use of alternate baits were also found important.

ANTU might be used to get rid of mice although it is less effective against these than against rats. Dogs may be poisoned by it and some were accidentally killed during the Baltimore campaign, although none of the more than 500,000 residents who had contact with ANTU were even made sick by it. Rabbits are not affected and chickens can be fed ANTU by the spoonful without harm.

Dogs, fortunately, are pretty well protected against ANTU poisoning by the fact that it causes them to vomit and so get rid of the poison. This and the fact that the chemical is almost insoluble furnish a guide to treatment of humans if any should ever be poisoned by it. No antidote has yet been discovered but immediate washing out of the stomach is advised by Dr. Richter. No fluids should be given. Dr. Richter also advises giving oxygen in case of ANTU poisoning.

ANTU was discovered as a result of studies Dr. Richter had been carrying on before the war, with no idea of developing a rat poison. He was working on the problem of taste as a guide to selection of food, seeking answers to questions such as why some persons develop an abnormal craving for salt or other diet items.

Rats were used in the studies and Dr. Richter found that these animals could

FROM OKINAWA—These "habu" snakes, patterned in yellow and green, are now at the National Zoological Park in Washington, D. C. Photograph by Fremont Davis, Science Service staff photographer. (See next page.)

select nourishing foods and avoid poisonous substances so long as their taste nerves were intact and functioning.

One afternoon he gave the rats a chemical often used for taste tests in humans. This is phenyl thiourea, which tastes very bitter to most persons though some cannot taste it at all. As is done in the tests on humans, a few crystals of the chemical were put on the tongues of rats.

All the rats in the test were dead the next morning. This was a surprise, because phenyl thiourea previously had been considered non-poisonous. It had been safely used for a long time for taste and inheritance studies in large numbers of people.

The war value of this discovery was immediately apparent. Red squill, which is imported, was no longer available and other rat poisons were either in short supply or dangerous. At the same time, the danger of epidemics of typhus fever and other rat-borne plagues might increase during the war. So, at the suggestion of Col. Perrin Long, Dr. Richter continued to study phenyl thiourea under a grant from the Office of Scientific Research and Development.

He soon found that although the rats in his laboratory would eat enough of the chemical in their food to poison themselves, wild rats in the city dumps and grocery stores of Baltimore were more wary. Apparently the bitter taste of the chemical warned the rats or at least kept them from eating bait poisoned with it.

A search for related chemicals was made with the help of the E. I. duPont de Nemours Company who quickly supplied over 100 chemicals. Of these, alpha-naphthyl thiourea turned out to be the best. It is made from alpha-naphthyl amine and ammonium thiocyanate. These chemicals, commonly used in the dye industry, are not expensive and were not on the list of critical chemicals during the war.

When first supplied, ANTU carried traces of a perfume made in the same building. This doubtless was a pleasing odor to the chemical company's human customers. To the rats, however, it evidently stank and they would have none of it. This difficulty was overcome and ANTU was put into large scale field trials.

Hundreds of thousands of residents of Baltimore, although ignorant of the identity of this new rat poison, soon were gratefully aware of its power to rid their premises of rats.

Surprising and somewhat disappointing was the discovery that while ANTU is very poisonous to the Norway rat, the Alexandrine or black rat commonly found in many parts of the world is not as much affected by the poison.

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ZOOLOGY

Snakes from Okinawa

They are now at the zoo in Washington. Called "habu" they are long and slim, patterned in yellow and green. Small collection of axolotls is also recent acquisition.

See Front Cover

► POISONOUS snakes from Okinawa, 20 of them, long and slim, patterned in yellow-and-green, are at the National Zoological Park in Washington, D. C. The Okinawan name for them is "habu". They belong to the pit-viper family, which makes them kin to the American rattlers and copperheads, rather than to the Old World cobras.

Director William M. Mann states that they are rather quiet and unaggressive, "though they do offer to snap at you once in a while." In their native haunts they are sub-arboreal in habit, which means that they are rather fond of slithering around in the branches of trees. When annoyed they have a way of puffing out their throats, like pouter-pigeons or bullfrogs.

They have been here at the Zoo for several weeks, but until now their presence was held as restricted information, at the request of the Army Medical Corps, which brought the specimens to Washington.

Another recent acquisition at the National Zoological Park is a small collection of Mexican axolotls. One of these is shown in the photograph by Fremont Davis, Science Service staff photographer, on the front cover of this SCIENCE NEWS LETTER. These are six-inch-long salamanders in a permanently arrested state of development. Unlike normal salamanders, which begin life as larvae in the water but eventually emerge to live on land in damp places, axolotls retain a larval form all their lives, breathing with external gills and never developing lungs.

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Black, blue, and other colors in *diamonds* are due to impurities.

Electronic blanching of vegetables, or using a shot of high frequency electricity instead of the flowing steam or boiling water method, results in retaining in cabbage 10 times the amount of vitamin C as in the older method.

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ENGINEERING

Attacks 1,000 Homes Daily

Fire Prevention Week is designed to focus attention on the seriousness of fire losses and the simple precautionary measures to prevent them.

➤ EVERY DAY in the United States 1,800 fires take 28 lives. Fire, practically always caused by carelessness, daily attacks 1,000 homes, 130 stores, 100 factories, eight schools, seven churches and three hospitals.

In the last 12 months property destroyed by fire in the United States exceeded the damage done in England during the first two years of the German blitz.

Fire loss in the United States is the highest in the world, averaging $4 per capita, compared with a normal loss in England of less than $1, and less than 50 cents in Germany.

During the last decade in the United States a hundred thousand persons have burned to death. A hundred and seventy thousand have been burned and disfigured by fire. Three billion dollars worth of property has gone up in smoke. Six million fires have occurred.

At the present rate, the U. S. fire loss in 1945 will exceed $450,000,000, plus a human toll of some 10,000 lives. Fire Prevention Week, Oct. 7 to 13, is designated by proclamation of President Truman and the state governors to focus public attention on the seriousness of fire losses and the simple precautionary measures to prevent fires.

Fully 50% of all home fires could be prevented if proper construction and fire-resistant materials were placed at strategic points in the building of new homes or remodelling of old ones, estimates Percy Bugbee, general manager of the National Fire Protection Association of Boston, which for 50 years has been crusading to reduce the tragic yearly loss in the United States from fires.

With the tremendous volume of remodelling and new construction soon to begin, there are eight principal features of fire-safe construction which builders and home-planners should consider:

The heating plant should be properly constructed and installed, with adequate safeguards in the use of fire-resistant coverings on pipes, walls and ceilings of the room in which the heating plant is located.

Wiring must be safe and adequate, properly installed in the walls, and have sufficient outlets. The wiring circuit should be heavy enough to carry the electric load needed in modern homes.

Use fire-resistant roofing material such as asphalt shingles or similar protective covering which will resist wind-blown sparks and firebrands. Sparks falling on flammable wood roofs stand third among the major causes of home fires, and roof-communicated fires from sparks is the principal cause of conflagrations.

Be sure the chimney is properly constructed of sound masonry or brick, with the foundation of the chimney on the ground and not suspended on timbers. This is especially important in farm homes and low-cost housing, where chimneys frequently rest on timbers.

Adequate fire-stops should be built in concealed space within sidewalls and interior partitions, especially on the first floor. These fire-stops will keep the walls from becoming flues through which a fire starting in the basement or first floor can be sucked up through the whole house. The deep recess of closets under stairways also should be completely finished off to prevent a blaze spreading rapidly and engulfing the stairs, thus trapping people on the second floor of a burning building.

Place a strong door at the entrance from the basement into the house to serve as a fire-stop if a blaze starts in the basement or furnace room.

Basement ceiling should be plastered or covered with a fire-retardant material, and not left with joists and the underside of flooring exposed.

Use non-combustible, fire-retardant materials on the interior walls rather than combustible material that is easily set afire. In the opinion of the National Fire Protection Association, one of the most serious hazards in home construction is the use of combustible interior finish.

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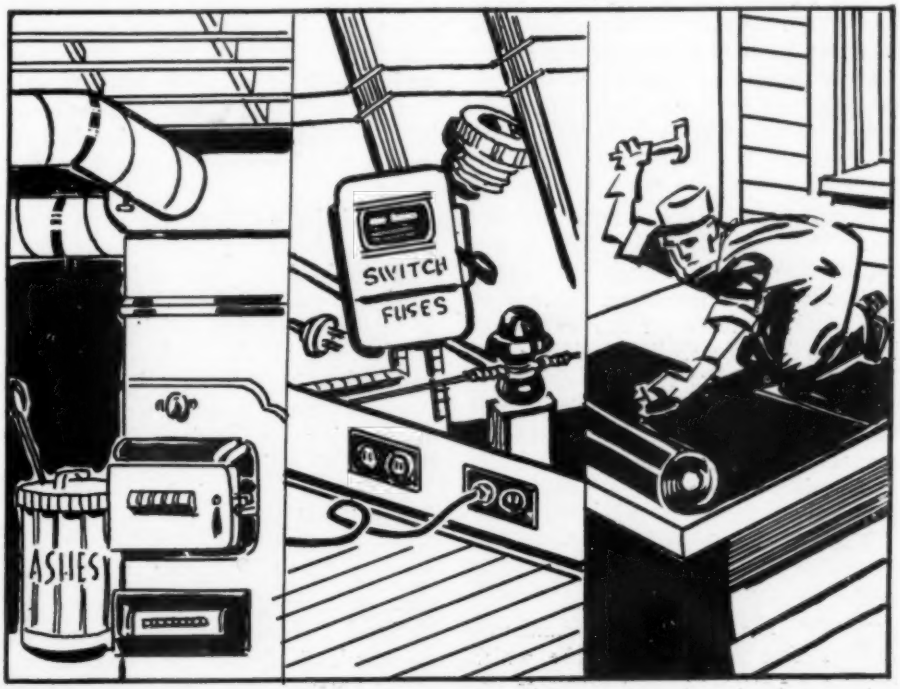
The grub of the *Japanese beetle* consumes grass roots as its principal food; the adult beetle feeds on a wide variety of plants, including certain fruits, ornamentals and vegetables.

A *blue frog* on exhibit in the Philadelphia zoo belongs to a family of green frogs, and is blue because, by a freak of nature, it lacks yellow pigment cells in its skin; the yellow and blue together would give green.



PREVENT FIRES—Home fires could be halved in number if properly constructed and fire-resistant materials were placed at strategic points in the building. Important among the features for fire-safe construction are the heating plant, wiring, and fire-resistant roofing material.

ORDNANCE

Proximity Fuze

The VT fuze for the Navy five-inch antiaircraft shell is one of the war's best kept secrets and ranks a close second in hastening the war's end.

➤ THE PROXIMITY fuze, a tiny radio set device in the nose of a projectile, is rated as the U. S. A. No. 2 secret weapon. Its use in antiaircraft fire directed at Jap suicide bombers, in artillery barrages in the famous Battle of the Bulge in France and in neutralizing Nazi buzz bomb attacks on London, is credited with a major help in winning both the European and Pacific wars.

The VT or variable time fuse, as it is also called, explodes a projectile as soon as it comes close enough to a target to inflict damage.

Along with the atomic bomb, the proximity fuse was one of the best kept secrets of the war. For two and a half years of war, projectiles and bombs fuzed with this proximity device inflicted terrific damage on the enemy. The only clue to its existence was what appeared to be unprecedented accuracy of gunfire; it was really a device that caused devastating destruction in spite of slight unavoidable inaccuracies in aim.

The VT fuze was developed by scientists of the Office of Scientific Research and Development at the request of the Navy Bureau of Ordnance. The research program was carried on in facilities provided by the Carnegie Institution of Washington and the Johns Hopkins University.

A record was set by its rapid development from an idea in the minds of ordnance experts to a triumph of quantity production. Research began in August, 1940, and 400 fuzes per day were coming from the assembly lines in September, 1942. By the end of 1944, the daily production was more than 40,000 in the factories of the five firms which did the assembly job. The price was gradually and rapidly reduced from $40 to $18 per fuze.

The VT fuze is an extremely rugged five-tube radio sending and receiving station which fits into the nose of a projectile. The heart of this miniature radio station is a vacuum tube which sends out electro-magnetic waves or impulses at the speed of light—186,000 miles per second. The impulses are reflected back to the tube by any target that gives a radio reflection, such as metal objects, water or earth.

The fuze works on the same principle that causes a train or fire engine whistle to sound higher in pitch as it approaches. The frequency of the electric signals sent out by the fuze is kept constant, but as the shell approaches its target, more impulses per second are reflected by it back to the fuze, the frequency increasing in proportion to the speed of both shell and target. The fuze can, of course, be set to work the detonator at any frequency necessary to insure destruction of the approaching target.

If a VT-fuzed projectile, in flight, passes within 70 feet of an airplane, reflected impulses act on the fuze circuit to trigger a switch. The switch causes an electrical detonator to set off the main explosive charge in the projectile.

The VT fuze has tremendously simplified the task of the men behind the five-inch guns, the Navy's principal long-range antiaircraft weapon. Before the VT fuze was created, time fuzes were used in 5-inch shells to obtain destructive air bursts. But time fuzes required not only that the time of flight from gun to target be calculated accurately, but that each fuze be "set" for this time. A slight error in fuze-setting could cause the shell to explode at a harmless distance from the target.

Use of the VT fuze eliminates fuze-setting, excludes errors inherent in time-fuze mechanisms, and makes possible maximum results at the split second speed demanded by modern antiaircraft fire. A VT-fuzed projectile explodes automatically when it reaches a point where its fragments can shower a target. When the gun is properly directed, all a gun crew has to do is load and fire.

The threat of the airplane to the surface ship stimulated the search for a practical proximity fuze. In the summer of 1940, the Navy pushed the development of such a device, requesting the National Defense Research Committee, a research division of the Office of Scientific Research and Development, to begin research on various types of proximity fuzes. The actual research program was carried out by a section of NDRC, headed by Dr. Merle A. Tuve, of Chevy Chase, Md., chairman of the scientific group which brought the difficult research problem to a successful conclusion.

The importance of proximity fuzes for high velocity shells launched Dr. Tuve's section immediately on the development of vacuum tubes and other miniature electronic parts so rugged that they could withstand the shock of being fired from a gun with a force of 20,000 times that of gravity and the centrifugal pressure created by projectile rotations as high as 475 a second. The components had to be so small that a complete radio transmitter-receiver, with amplifier and power supply, could be installed in the nose of a projectile. Photoelectric triggering devices were the first to be successful, but circuits based on radio reflection were later adopted as the most effective for the purpose.

Large scale production of a peculiarly complex device was a marvel of production skill. Assembly operations were carried on by five companies—Crosley Corporation, Sylvania Electric Products, Inc., Radio Corporation of America, Eastman Kodak Company, and McQuay-Norris Manufacturing Company. A total of 87 different firms using 110 different factories were engaged in some phase of production work.

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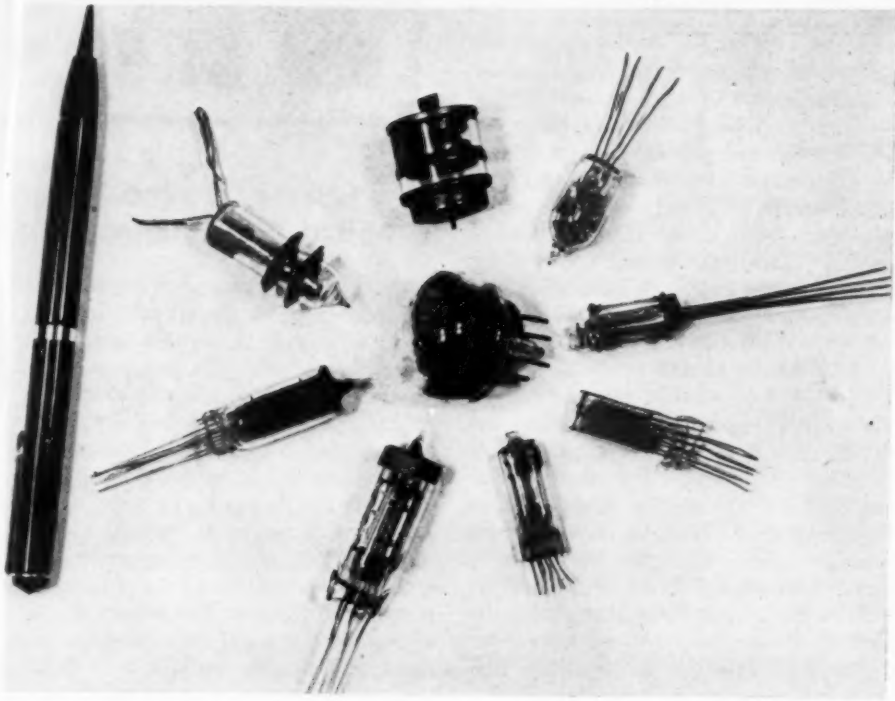
The *wood bison* is larger, darker in color, and shaggier than the bison found on the Plains.

DESTRUCTIVE!—This fuze weighs 1.9 pounds and is 7.5 inches long. It is used in the three inch Navy shell.



PINT-SIZED—This fuze, holding its own five-tube radio sending and receiving set, explodes a projectile as soon as it comes close enough to a target to inflict damage.

CHEMISTRY

Gas Attacks Anticipated

Soldiers were equipped with the latest type of gas masks, protective coverings, protective ointment and special eyeshields.

➤ NO SERIOUS attempts were made by either the Nazis or the Japs to use gas against American troops during the war, but if they had, relatively little harm would probably have resulted because the American forces at all times, wherever located, were fully prepared for large-scale gas attacks. Details of protective methods adopted are now revealed by the Army Chemical Warfare Service.

Soldiers were equipped with the latest types of gas masks, protective coverings, protective ointment and special eyeshields. Decontamination companies of the Chemical Warfare Service were ready with vehicular and portable equipment to clear the way through contaminated areas by chemical neutralization or other scientific means.

Gas masks, perhaps, come first in the individual protective devices. They purify the air the wearers breathe and also protect eyes and faces. The canister is the gas mask's most important part if the mask is properly fitted to the face. It is a metal container through which the wearer inhales. He exhales through an outlet valve near his mouth. Inhaled air passes through a filter in the canister that removes microscopic particles, poisonous or otherwise, and then through layers of activated charcoal which absorb remaining molecules of irritants.

Since adsorbent charcoal can soak up only a given quantity of poisonous molecules before becoming saturated, no military mask will afford indefinite protection in heavy concentrations. The standard canister will not protect against certain industrial gases such as carbon monoxide, ammonia, hydrocyanic acid and oil vapors, but will protect against all toxic gases likely to be used in war.

Protective covering is a cellophane cover designed to protect individual soldiers against blister gas sprayed from the air. It is an envelope large enough to cover a crouching man and his pack. The top part is transparent. It is very light in weight, and occupies, when folded, very little space. In use the soldier punches a hole through its side through which he sticks his rifle. It is discarded after being used.

The protective ointment issued the soldiers is in a tiny kit and is spread on all exposed skin of the body. It prevents injury from a gas, and can also be used as first-aid treatment and for decontamination of personal equipment.

The special eye shields are stamped out of a clear, flexible plastic, and protect the eyes from blister gases and toxic agents. Four were issued with each gas mask. Held by an elastic band around the head, they can be worn in an alert position on the forehead like an eyeshade, or pulled down on the bridge of the nose in the ready position.

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ELECTRONICS

Electrical System Defects Shown in Flight

➤ A PROJECTED image on a screen showing defects in the electrical system of aircraft engines is one of the outstanding features of the new ignition analyzer developed by D. Napier and Son and the English Electric Company.

About the size of a portable typewriter, the analyzer, taking power from 220 volt A. C. mains or a 6, 12 or 24 volt accumulator, may be adapted as a permanent instrument on multi-motored planes. Peaked figures on the screen, one for each spark plug, arranged in the firing order of the engine, remain unchanged in shape and intensity when the ignition system is functioning properly, but flicker and alter shape in direct ratio to defects in corresponding spark plugs.

Easily diagnosed by visual characteristics of the fault, excessive spark gaps give a high figure, short-circuited gaps a correspondingly low figure, while an occasional miss shows instantly as a definite flicker. Defects in the magneto or distributor alter the entire row of figures as a unit.

By locating and diagnosing minor defects, dormant until the moment of breakdown, this tester can minimize loss of flying time and aid maximum engine efficiency. Operated in flight, potentially serious engine failure due to faulty ignition may be revealed, giving the pilot adequate time to find suitable terrain should a forced landing be necessary.

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Less *sugar* is required in a cake if dried fruits are used as filling.

GENERAL SCIENCE

Hearings on Science Bills To Begin Oct. 8

➤ LEADING scientists, industrialists, labor leaders and government officials will urge increased Government support of scientific research in joint hearings before the Senate committees on military affairs and commerce for three weeks beginning Oct. 8.

Following President Truman's message asking for a single federal research agency for scientific research, joint hearings have been arranged for the Kilgore-Johnson-Pepper, Magnuson and Fulbright bills.

Those who have been invited to appear during the first week are: President Isaiah Bowman, Johns Hopkins University; President James Conant, Harvard University; Dr. Harlow Shapley, Harvard University; Eric Johnston, U. S. Chamber of Commerce; Ira Mosher, National Association of Manufacturers; William Green, American Federation of Labor; Philip Murray, Congress of Industrial Organizations; Edward O'Neal, Farm Bureau Federation; Charles Goss, National Grange; James G. Patton, National Farmers Union; Dr. Vannevar Bush, Office of Scientific Research and Development; Harold D. Smith, Bureau of the Budget; Secretary Robert P. Patterson, War Department; Secretary James V. Forrestal, Navy Department; Dr. Jerome C. Hunsaker, National Advisory Committee on Aeronautics; Secretary Henry A. Wallace, Department of Commerce; Secretary Harold L. Ickes, Department of Interior.

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BOTANY

Japanese Honeysuckle Has Some Redeeming Traits

➤ JAPANESE honeysuckle, a trailing vine with sweet-scented flowers that has become a smothering pest in open woodlands all along the Atlantic coast from Connecticut to Florida and inland as far at least as Tennessee, has some redeeming traits. Like one of those baffling characters in fiction, the villain who isn't altogether bad, it offers shelter and food to game birds and deer in time of stress, C. O. Handley, leader of the Virginia Cooperative Wildlife Research Unit here, reports in the *Journal of Wildlife Management,* (Oct.).

The tangled thickets of the vine, scrambling over bushes and fallen trees, offer almost ideal cover for bobwhite quail, wild turkeys and other upland game birds, as well as for cottontail rabbits. Turkeys sometimes make their nests in such thickets.

Game birds, and some song birds as well, eat the honeysuckle berries. These do not seem to be a preferred food, but they have the advantage of being available when berries and seeds on lower-growing plants are buried under deep snow or coated over with ice after glaze-storms. Chemical analysis of the berries indicates that they are fairly high in available food content.

Japanese honeysuckle retains a large part of its green leaves through the winter, so that it makes acceptable browse for deer. Here again, the vine is especially valuable in times of deep snow, as an emergency ration. The leaves are also eaten by rabbits and to some extent by game birds. Chemical analysis shows a food value comparable to that of timothy hay.

Although Japanese honeysuckle is a terrible nuisance in open woodlands, especially where the trees are trying to reestablish themselves after cutting-over or fire, it cannot stand much shade, and dies out after the new forest gets its growth and establishes a closed canopy overhead.

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ENGINEERING

Super-Pulverizing Process For Low-Grade Anthracite

➤ WITH FUELS of all kinds on the scarcity list and winter in the offing, more than ordinary interest attaches to a new apparatus for getting maximum heating value out of coal, especially low-grade anthracite with high ash content, on which U. S. patent 2,385,508 has been granted to Edgar S. Hammond of Bloomfield, N. J.

Essentially the device consists of a closed, racecourse-shaped loop of strong steel tubing. The coal, ground fine, is blown in near one end by a jet of dry, superheated steam. Additional steam jets send the particles around and around the course, jostling together and reducing each other further in size. An outlet near the other end takes off the inner part of the coal-powder stream, in which the particles have been reduced to microscopic fineness. Blown directly into the furnace firebox, this super-powdered coal burns with a thermal efficiency said to approximate that of gas.

Rights in the patent have been assigned to the Blaw-Knox Company.

Science News Letter, October 6, 1945

IN SCIENCE

GEOGRAPHY

New Guinea Shangri-La Identified by Photographs

➤ THE NEW Guinea Shangri-La or Hidden Valley, from which three survivors of a plane crash were rescued by glider plane during the past summer, is now identified as the Grand Valley of the Balim River, discovered and explored in 1938 by a combined American and Dutch scientific expedition organized and led by Richard Archbold of the American Museum of Natural History.

The identity of the valley came about through a comparison of photographs taken by the Army just before the survivors were rescued with airplane photographs taken by the Archbold expedition. The identity is acknowledged by the Army, and particularly by Col. Ray T. Elsmore, who directed the recent rescue operations.

Early in the exploration of the Grand Valley by the Archbold expedition it was found that their flying boat could be landed near the lower end of the valley. A base camp was located there, supplies were flown in to this landing place, and from it the whole party of nearly 100 men was flown out of the valley when its work was done.

Science News Letter, October 6, 1945

ELECTRONICS

New Plant to Be Built For Electronic Research

➤ A GIGANTIC plant for the development of electronic equipment will soon be under construction in Syracuse, N. Y. It will provide laboratories for scientific research in the electronic field and modern factory buildings for the construction of television apparatus, radar for safety of ships and airplanes, frequency modulation radio and wire recording for entertainment and education, and many other types of equipment that depend upon electronics for operation.

The new plant, a project of the General Electric Company, will cost approximately $10,000,000 and will occupy 155 acres, laid out and landscaped like a college campus. The floor area involved is over a million square feet. The size of the plant is an indication of the part that electronics is expected to play in America's industrial future.

Science News Letter, October 6, 1945

CE FIELDS

WILDLIFE

Disease from Moldy Corn Kills Wild Ducks

➤ WOOD DUCKS in considerable numbers were made sick, and many of them died, after breathing clouds of spores given off by a mass of moldy corn on which they were feeding, in a flooded area near Havana, Ill., it is reported in the *Journal of Wildlife Management*, (Oct.). Dissection of several of the dead birds showed their lungs and other organs in the upper parts of their bodies to be overgrown with a growth of white mold, which was identified as *Aspergillus fumigatus*—a botanical second cousin of the mold from which penicillin is extracted.

Eating the moldy corn seems not to have caused the ducks any direct injury. It seems more probable that the microscopic propagating bodies, or spores, stirred into the air as the ducks were trampling in the spoiled grain, were breathed into their lungs and germinated there, producing effects like those of pneumonia.

A search of the records for similar cases disclosed a number of isolated instances, in which gulls, owls and other bird species beside ducks were the victims. A disease called brooder pneumonia, said to be well known to breeders of chickens, ducks and ostriches, is blamed on the same kind of mold.

Investigators of the present outbreak were Frank C. Bellrose, Jr., and Harold C. Hanson of the Illinois Natural History Survey, and Dr. P. D. Beamer of the University of Illinois.

Science News Letter, October 6, 1945

ELECTRONICS

Radio-Telephone Circuits Permit 24 Conversations

➤ RADIO-telephone circuits permitting 24 two-way simultaneous conversations on a single radio-frequency carrier wave, have been successfully demonstrated at the headquarters building of the International Telephone and Telegraph Corporation in New York, when two groups of 24 men in separate rooms conversed at the same time, the conversation passing through relay stations at Hazlet and Nutley, N. J.

The experimental network utilizes the pulsetime modulation principle of transmission recently perfected by the Federal Telephone and Radio laboratories and other laboratories of the corporation after nine years of research. Only one transmitter and receiver are required at each location for the 24-channel simultaneous communication.

Common waveguides and antennas are used both for transmission and reception: parabolic reflectors, eight feet in diameter, serve to beam the 1,300 megacycle carrier. The reflector at the New York end is located on the roof of the 35-story International Telephone building, those at the two New Jersey relay stations are located on high towers.

The present 24-channel arrangement makes use of a combination of pulsetime modulation plus a system of electronic time selection, certain fractions of each second being allotted each channel for the transmission of its signal. In contrast to mechanical systems evolved in the past, the method of time selection used is entirely electronic in operation, and was developed especially for this purpose.

It permits 24-channel voice communication with all the fidelity of modern telephone standards, it is claimed, and is much more compact than equipment designed for frequency selection.

Science News Letter, October 6, 1945

CHEMISTRY

Wood Protected from Acids By Plastic-Impregnation

➤ PROTECTION of wood from acid solutions or fumes is provided by a process in which the wood is impregnated with a plastic, developed in the wood preserving division of Koppers Company, Inc. The plastic-impregnated wood will be known as Asidbar. The treatment increases the weight and hardness of the wood, and gives it resistance to abrasion, water, and chemicals. It gives a black finish that need not be painted.

The treated wood is suitable for flooring on platforms and in railroad cars and other structures subject to rough use. It will probably be suitable for greenhouse construction where untreated wood is subject to rapid decay due to moisture and other conditions.

In the treatment, the plastic material is liquefied by high temperature and the wood is immersed in the compound in a sealed retort. The plastic is forced deeply into the wood fibers by high pressure at high temperatures.

Science News Letter, October 6, 1945

PUBLIC HEALTH

Polio Foundation Gives Large Sums for Education

➤ LARGE SUMS for the education of new workers to help in the fight against poliomyelitis were granted by the National Foundation for Infantile Paralysis during the past year.

The American Association of Medical Social Workers was given $101,760 for scholarships in medical social work, the foundation's annual report states.

For scholarships in health education $60,000 was granted to the U. S. Public Health Service. Because of the acute need for more nurses specially trained to give the orthopedic care polio victims require, a grant of $13,400 for scholarships in this field was made to the National Organization for Public Health Nursing.

Altogether the foundation allotted during the year ending May 31 the "unprecedented total of $4,157,814.15 for research, education and the treatment of patients." Almost half of this was appropriated for training of polio fighters in various fields and for broadening public understanding of the problem.

One of the largest single grants was $90,000 to the University of Wisconsin for study of the relation of nutrition and diet to resistance and susceptibility to infantile paralysis.

So that a new hospital at Caracas, Venezuela, built specially for treatment of infantile paralysis, might give even better service, it received a grant of $2,500 for training a brace-maker.

Although no preventive or cure for the disease has yet been found, the foundation continued to support research on viruses which cause this and other diseases in the hope of finding means of combatting them or checking their spread.

Science News Letter, October 6, 1945

GEOLOGY

Fossils Depict Life Millions of Years Ago

➤ FOSSILS depicting the forms of life which existed in the Midwest more than 280,000,000 years ago have been acquired by the University of Illinois. The 200,000 items composing the private collection gathered by R. R. Rowley, who made many important contributions to paleontology, include 147 type specimens, or originals from which a new genus or species was identified. Numerous others were set aside by Mr. Rowley as new types but not described by him before his death a decade ago.

Science News Letter, October 6, 1945

MEDICINE

Tropics Don't "Thin" Blood

Veterans need not fear "tropical anemia" as result of service in the Pacific. Blood values are generally the same everywhere.

➤ G. I.'S RETURNING from the Pacific can banish one disease fear from their minds, that of "tropical anemia" or "thinning" of the blood.

This condition does not occur in the tropics, Dr. Christopher J. Hamre, chairman of the zoology department of the University of Hawaii, said. Existence of "tropical anemia" has been disproved by many scientific studies all over the world, the zoologist said.

Dr. Hamre, who has made extensive blood value studies in Honolulu and compared them with other studies, said that blood values are generally the same everywhere. Furthermore, no blood value differences are apparent on racial lines.

"If a man is in good health, has no disease such as malaria, and has had proper food, he need not worry that the tropics have 'thinned' his blood," Dr. Hamre said.

The zoologist's study shows that there are no significant differences in blood values of men in latitudes ranging from Boston to Bombay and Manila. Determination of these blood values was made by measuring hemoglobin and red blood cell content, the two best yardsticks of blood quality.

Explaining the discomfort from cold which many persons feel on returning to the mainland, Dr. Hamre said this is caused by other factors, to which the body becomes accustomed without difficulty over a period of time.

Dr. Hamre cited the following examples of comparable blood values as measured by hemoglobin and red blood cell content:

Hemoglobin count (grams per 100 cubic centimeters of blood): Honolulu, 15.10; Kansas City, 15.83; New Orleans, 15.87; Boston, 15.06; Manila, 14.11; Bombay, 15.37; Buenos Aires, 14.80.

Number of red blood cells per cubic millimeter: Honolulu, 5,080,000; Boston, 5,350,000; Manila, 5,200,000; Bombay, 5,110,000; New Orleans, 5,260,000.

The differences in these figures are not in any instance significant, Dr. Hamre said.

In his Honolulu study, Dr. Hamre tested the blood of 137 young men who had lived in the Islands for from two years to all their life. Persons of Caucasian, Oriental, and mixed descent were used as subjects.

Dr. Hamre added that no differences in blood values were found on racial lines in either his study or the studies made in other regions of the world.

Science News Letter, October 6, 1945

BIOCHEMISTRY

Streptomycin's History

New drug that may become partner of penicillin is the result of a five-year search with many failures along the way.

➤ STREPTOMYCIN, newest weapon in the germ-fighter's armory, was no lucky chance discovery, Dr. Selman A. Waksman, bacteriologist at the New Jersey Agricultural Experiment Station, declared in an address in New York. He and his associates put in five years of hard work searching for it, and had to reject, as failures, several other compounds that at first seemed quite promising.

Dr. Waksman told the story of the search for streptomycin as guest of Watson Davis, director of Science Service, on "Adventures in Science," heard over the network of the Columbia Broadcasting System.

Streptomycin, now undergoing its first careful clinical tests, is not intended or expected to be a rival or replacement for penicillin. If it proves of value in the treatment of human ills it will rather act as a partner or complement to the well-known mold-made medicine, Dr. Waksman explained. This is because it will attack certain germs on which penicillin has little or no effect. In the class of germs that are immune to penicillin but which streptomycin will attack are the causes of such diseases as typhoid fever, dysentery, undulant fever, tularemia, whooping cough and plague.

It is not strictly correct, Dr. Waksman pointed out, to refer to either streptomycin or penicillin as germicides. They do not kill the germs outright but simply prevent them from growing and multiplying. The germs, unable to grow, gradually die. A new term has had to be coined to designate substances of this kind; they were christened "antibiotics" in the New Jersey Experiment Station laboratories, where much of the pioneer work in their investigation and use has been carried out. Some antibiotics are also germicides, but not all of them.

Penicillin's origin in a soil-inhabiting fungus or mold, *Penicillium,* is already well-known. But antibiotics do not all come from molds. One of the first to be discovered, gramicidin, comes from a species of soil bacteria. Streptomycin was found in a peculiar organism known as *Streptomyces griseus,* which is neither a bacterium nor a mold, but occupies a more or less intermediate position between these classes of lower plants, resembling bacteria in some respects, molds in others.

Science News Letter, October 6, 1945

PLANT PHYSIOLOGY

Vacuum Treatment Keeps Plants Fresh Longer

➤ A VACUUM treatment for certain cut flowers and plants which keeps them fresh and unwilted much longer than usual is announced by Dr. C. L. Hamner, R. F. Carlson and H. B. Tukey, of the New York Agricultural Experiment Station and Cornell University in Geneva, N. Y. (*Science,* Sept. 28).

Vacuum-treated narcissus flowers with six-inch stems were fresh and in excellent condition after six hours of exposure to direct sunlight at a temperature of 80 degrees Fahrenheit. Untreated flowers were badly wilted after 30 minutes and after five hours their petals were dry and crisp.

The treated flowers after the sunlight exposure were brought into a warm room with a temperature of 80 degrees Fahrenheit and left on a laboratory table overnight. The next morning, 21 hours after the vacuum treatment, they were showing signs of wilting, and by five p.m., 30 hours after treatment, they were all badly wilted.

Lilac branches placed in water immediately after treatment stayed fresh for

five days, whereas untreated branches in water began to wilt within two days and were badly wilted in three.

Good results were also obtained with tomato plants, trillium flowers and some kinds of roses.

The treatment consists essentially in placing the plants or flowers in water in a drier. Air is pumped out and is replaced in the plants and flower stems by water.

Best results, in general, were obtained with plant materials having large leaves and stems and large inferior ovaries capable of serving as reservoirs.

Science News Letter, October 6, 1945

AERONAUTICS

Model Plane Used As Antiaircraft Target

➤ A RADIO-controlled oversized model airplane, carrying no pilot or crew, is used by the Army as a target for antiaircraft gunnery practice, it is now revealed. The 12-foot wingspan plane, powered with an eight-horse-power engine, cuts capers in the sky by radio control which finally stops the engine, opens a parachute and lowers the target safely to the earth.

When wanted for use, the small plane, with its engine wide open, is catapulted like a stone from a slingshot into the air, to be maneuvered by the radio apparatus into steep climbs and deep banks, travelling at about 125 miles an hour. When the gunnery practice is over, a switch is thrown on the remote control apparatus, causing a hatch on the topside of the target plane to open, releasing a parachute by means of which the plane slowly descends.

The radio control is by ultra-high frequency carrier which is generated and modulated by five different audio frequencies. Of these five frequencies, four are selected by the stick on the control box on the ground and are used to effect guiding of the plane. The fifth holds the parachute in place for the eventual landing.

Science News Letter, October 6, 1945

CONSERVATION

Forest Conservation as an International Plan

➤ FOREST conservation and expansion under a plan for international collaboration is recommended in a recent report to the United Nations Interim Commission on Food and Agriculture by that body's technical committee on forestry and primary forest products, according to Lyle F. Watts, a member of the committee and chief of the U. S. Forest Service. Forest conservation is a critical world problem, and must be solved if the world's supply of wood is maintained, the report states, despite constantly shrinking supply and heavy demands.

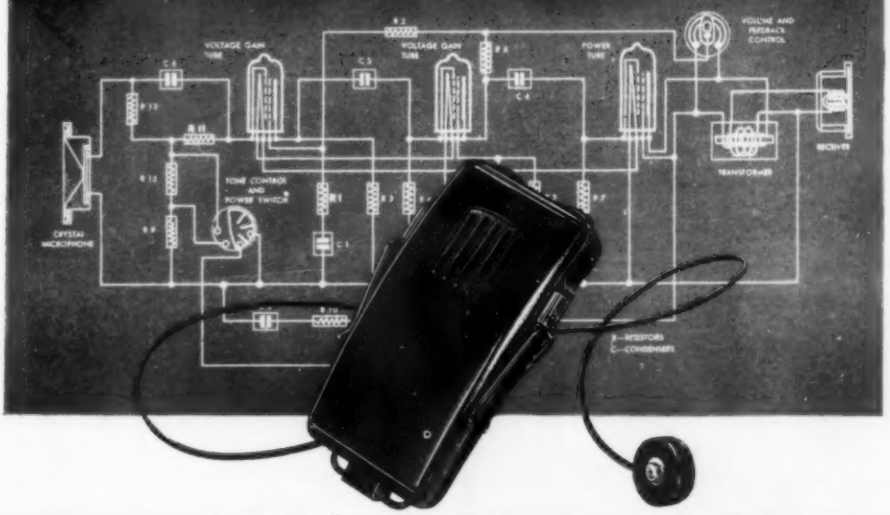
"The world is confronted," says the report, "with the inescapable fact that the forests—sole source of wood—are steadily diminishing. . . . Today the world stands on the threshold of developments in the use of wood that may be as revolutionary as the invention of the steam engine or the introduction of technology to the farm."

The technical forestry committee making the report is headed by Dr. Henry S. Graves, former chief of the U. S. Forest Service and dean emeritus of the Yale School of Forestry. On it are representatives of Great Britain, Canada, Soviet Union, France, Norway, Brazil, Czechoslovakia, and China.

Science News Letter, October 6, 1945

Newly born *young whales* are astonishingly large in comparison with their mothers; a blue whale at birth is from 23 to 26 feet in length, approximately one-quarter the length of an adult.

What Makes a Good Hearing Aid . . . No. 4 of a Series



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4. **Reduced internal noise**
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6. **Longer electron tube life**—Stabilized Feedback compensates for changes in tube characteristics due to aging.
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THE WESTERN ELECTRIC was the first hearing aid that successfully utilized the Stabilized Feedback Circuit, which was introduced originally by Bell Telephone Laboratories. And the new Western Electric Model 63 provides the latest application of Stabilized Feedback in a hearing aid of advanced design.

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Western Electric Hearing Aids

MADE TO BELL TELEPHONE STANDARDS

Do You Know?

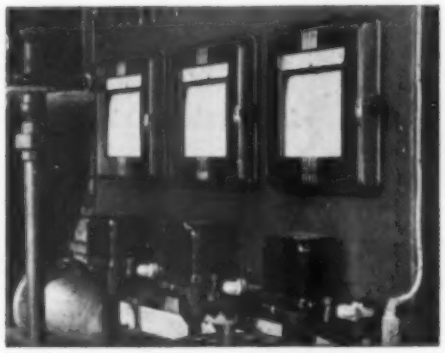
Pyroligneous acid is the crude acid obtained by the dry distillation of wood.

Tobacco pipes, probably 2,000 years old, have been found in Mexico.

Woodchucks, when old enough to leave their mothers, set themselves up in new or vacant burrows, and as a general rule live alone.

Fresh green and leafy *vegetables* are rich in vitamin A, and when gathered are nearly equivalent to oranges in vitamin C; they often lose 75% of the latter through standing, chopping, bruising and cooking.

The Chesapeake Bay retriever is one of the few breeds of *dogs* of American origin; it had its beginning about 140 years ago when hunters needed a powerful dog to retrieve wild waterfowl from the waters of the bay.



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ORNITHOLOGY

NATURE RAMBLINGS

by Frank Thone

Bound to the Land

➤ COLUMBUS, the school histories all tell us, knew he was nearing land when he sighted birds on the wing. What kind of birds they were the record does not state; they may have been flights of inland species on their autumnal migration, or they may have been gulls or cormorants or some other shore-haunting birds taking a jaunt out beyond their ordinary range. Whatever they were, the Admiral of the Ocean Sea had an experienced sailor's knowledge of what to look for, and what not to expect, when far out of sight of land, and he knew well enough that basically sea birds are really land birds.

It is only natural for sea birds to stick close to the land most of the time. Practically all of them are fish-eaters, and despite their watery way of life fish also are found in greatest abundance in inshore waters. Moreover, many species of sea birds depend to a large extent on finding dead fish and other sea-food carrion cast up on shore, and naturally they must stay near the strand-line for that reason. Seagulls especially have a penchant for collecting garbage; their hope for scraps is what leads many of them to follow departing steamers, sometimes for many miles.

However, the farthest departures that sea birds make from the seashore are not on flights out over the open ocean but on expeditions inland. Seagulls are occasionally reported from all of our larger rivers, and they are as familiar a sight on the shores of the Great Lakes as they are on any salt-water coast.

Probably the most landlocked of all seagull rookeries is the one on a couple of rocky islets in Great Salt Lake. The story of the timely rescue of the Mormon pioneers' first crop by flocks of these birds, just as they were being devoured by a plague of grasshoppers, is familiar to every child in the mountain country.

Even farther inland, and at a higher elevation, too, are the colonies of seagulls and pelicans on Yellowstone Lake, where they have taken over one or two small islands as nesting sites. Although most of these birds migrate to the Gulf of California when cold weather comes, a few of them regularly hang around all winter, picking up their living in places along the shore where hot springs keep the lake water warmed up enough to prevent the formation of ice.

Science News Letter, October 6, 1945

A small amount of *ascorbic acid* powder added to the syrup as peaches are packaged for freezing will prevent the browning of the frozen fruit.

Cheetahs, the hunting-leopards of southwestern Asia and northern Africa, are rated as the fastest of all quadrupeds and have been clocked at 70 miles per hour.

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New Machines and Gadgets

⚙ *POSTAL SCALE, for weighing letters, is a single curved piece of material capable of rocking on its base. One upward-projecting curved arm has a slot to hold a letter, the weight of which causes the device to rock. The other arm, bent inward to the center of the arc, carries a freely-swinging pointer to indicate the weight.*

Science News Letter, October 6, 1945

⚙ *SPECIAL reel placed six feet in front of a bazooka makes it possible to shoot a telephone wire across a river 200 yards wide. The payout end of the wire on the reel is formed into a slip loop and taped to the muzzle of the bazooka from which it is picked up by the departing rocket projectile.*

Science News Letter, October 6, 1945

⚙ *GARMENT hanger, to hold various articles of wear at the same time, resembles the familiar wire hanger, but has two recesses in the upper wire of the frame to hold the shoulder straps of a slip, and movable clips on the lower wire to hold a skirt.*

Science News Letter, October 6, 1945

⚙ *AUTOMATIC cycle washers for installation in kitchens will soon be available. One, shown in the picture, is designed to harmonize with other equipment in the average kitchen. Electrically operated, its engineering details have not yet been revealed.*

Science News Letter, October 6, 1945

⚙ *PORTABLE medical refrigerator used in the Army is for the storage of whole blood, biologicals and perishable drugs. Made of aluminum, it weighs 175 pounds. It is electrically operated by a one-eighth horsepower motor, and has two compartments in which different temperatures are maintained automatically.*

Science News Letter, October 6, 1945

⚙ *DOUBLE-TRACK truck tires are protected by a soldier invention from stones and sharp objects that would otherwise become lodged between the tires. It is a simple bar that, inserted between the tires, rests on the wheel hub. When the truck is in motion, the bar pushes stones out of the path.*

Science News Letter, October 6, 1945

⚙ *VACUUM-PRODUCING equipment, an essential part of a cold-water de-aerator which is attached to water pipes, frees the water of oxygen and carbon dioxide without the use of chemicals. These gases cause destructive corrosion in pipes and boilers. A spray created in the apparatus makes gas removal easier.*

Science News Letter, October 6, 1945

If you want more information on the new things described here, send a three-cent stamp to SCIENCE NEWS LETTER, *1719 N St., N. W., Washington 6, D. C., and ask for Gadget Bulletin 279.*

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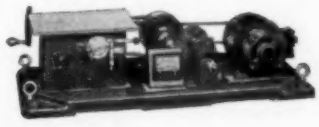

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Timer with a-c clutch has toggle switch for manually starting the pointer. Timer with d-c clutch has binding posts only for attaching d-c control circuit for starting and stopping the pointer. Both timers have a-c clock motors, and pointers are reset with knob.

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Books of the Week

➤ INTERESTING popular accounts of the origins of a number of our more common cultivated plants fill the pages of GREEN CARGOES, by Anne Dorrance. It traces the history of man-controlled plant migrations from the great discovery voyages of the Renaissance down to the highly specialized expeditions of the present time. (*Doubleday*, $2).

Science News Letter, October 6, 1945

➤ PACIFIC lands and their inhabitants have perforce become of great interest to Americans during the past few years, and will continue so for many years to come. To most of us, the animal life of these lands stands second in interest only to the human population. A ready welcome, therefore, should await MAMMALS OF THE PACIFIC WORLD, by T. C. Carter, J. E. Hill and G. H. H. Tate, a compact book giving popular descriptions of most species, with vivid black-and-white text illustrations. (*Macmillan*, $3.)

Science News Letter, October 6, 1945

➤ FEW MEN who write autobiographies are able to call the turn as closely as did Francis B. Sumner. On Sept. 3 his newly published LIFE HISTORY OF AN AMERICAN NATURALIST was released for sale. On Sept. 8 he died. In his book he is as he was in life: a tireless observer of all kinds of living things, from mice to men, an exact reporter of all that he saw, a determined supporter of the truth as he knew it and often a pungent commentator on the errors and foibles of men whose gift of reason should, he felt, have deterred them from some of the irrational behavior in which they indulged. (*Cattell*, $3.)

Science News Letter, October 6, 1945

➤ MOLDS of the genus *Aspergillus* have long been recognized as important both negatively as spoilage organisms and beneficially as food-ripening agents. More recently they have taken on new importance as converters of carbohydrates into various compounds useful in industry. Mycologists in all these fields, therefore, will welcome A MANUAL OF THE ASPERGILLI, by a pair of masters in their science, Charles Thom and Kenneth B. Raper (*Williams and Wilkins*, $7). The data presented are complete and marshalled in scholarly fashion; the illustrations are the best of their kind and help greatly in bringing out critical distinctions.

Science News Letter, October 6, 1945

Just Off the Press

THE ATOMIC AGE OPENS—*Pocket Books*, 252 p., 25 cents. A book for the layman, written before the Smyth report was issued.

THE FUNDAMENTALS OF ELECTRONICS AND THEIR APPLICATIONS IN MODERN LIFE—Henry Lionel Williams—*Blakiston*, 231 p., illus., 69 cents. A volume in New Home Library series.

HEALTH INSTRUCTION YEARBOOK 1945—Oliver E. Byrd, comp.—*Stanford Univ. Press*, 344 p., $3. A health text and reference book containing outstanding articles of the past year in the field of health.

MICROBES OF MERIT—Otto Rahn—*Cattell*, 277 p., illus., $4. The story of bacteriology told for the layman.

THE PSYCHOANALYTIC STUDY OF THE CHILD, Vol. 1, 1945—Otto Fenichel and others, eds.—*International Universities Press*, 423 p., $6.

A SHORT DICTIONARY OF ARCHITECTURE, Including Some Common Building Terms—Dora Ware and Betty Beatty—*Philosophical Lib.*, 109 p., illus., $2.75. With an introduction on the study of architecture by John Gloag.

SOUTH AMERICAN HANDBOOK—H. W. Wilson, 842 p., illus., $1.25. 22nd ed. Annual guide and book of reference to Cuba, Mexico, Central and South America.

THE STORY OF THE GREAT GEOLOGISTS—Carroll Lane Fenton and Mildred Adams Fenton—*Doubleday*, 301 p., illus., $3.50.

UNITED NATIONS PRIMER—Sigrid Arne—*Farrar*, 156 p., $1.25.

VETEBRATE PALEONTOLOGY—Alfred Sherwood Romer—*Univ. of Chicago Press*, 686 p., illus., $7.50.

Science News Letter, October 6, 1945

AERONAUTICS

Daniel Guggenheim Medal Awarded Dr. T. P. Wright

➤ THE DANIEL Guggenheim medal for 1945 has been awarded to Dr. Theodore P. Wright, United States administrator of Civil Aeronautics in Washington, who is an outstanding figure in aviation both in America and abroad. The citation with the award reads, "For outstanding contributions to the development of civil and military aircraft, and for notable achievement in assuring the success of our wartime aircraft production program."

This award was created for the purpose of honoring persons who make notable achievements in the advancement of aeronautics. It is made possible by the Daniel Guggenheim Fund and has been in existence since 1928.

Science News Letter, October 6, 1945

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Laws of Matter Up-to-Date

Compiled by HELEN M. DAVIS, *Editor of* CHEMISTRY

1. A single ATOM is the tiniest particle of any chemical element that can exist by itself and retain the qualities that mark it as that element.

2. All material things in the universe known to our senses are composed of one or more CHEMICAL ELEMENTS.

3. Substances composed of more than one element are known as COMPOUNDS. Atoms of elements are held together in compounds by electrical forces in the outer parts of their structure.

4. The smallest unit of a compound, usually composed of two or more atoms, is known as a MOLECULE.

5. There used to be 92 chemical elements, from hydrogen ($_1H^1$) the lightest, to uranium ($_{92}U^{238}$), the heaviest. There are now two new elements, NEPTUNIUM ($_{93}Np^{239}$) and PLUTONIUM ($_{94}Pu^{239}$).

6. When elements are represented, as above, by their chemical SYMBOLS, the subscript number is the atomic number. This is different for each element. The superscript number represents the atomic weight.

7. One of the qualities characteristic of matter is weight or mass. ATOMIC WEIGHT is expressed on a relative scale, as compared with the weight of hydrogen which is taken as one.

8. ATOMIC NUMBER is the measure of the electric charge on the nucleus of the atom. Atomic weight is the measure of the atom's mass.

9. Different samples of the same element, when tested by chemists, are sometimes found to have different atomic weights. Lead which occurs with radium, for example, has a different atomic weight from ordinary lead.

10. In all other ways the two kinds of lead are chemical twins, exactly alike except for weight. Elements which differ in weight only are called ISOTOPES.

11. Uranium has several isotopes. The usual kind, whose atomic weight is 238, was used to produce the two new elements. U-235 was used to make the ATOMIC BOMB.

12. Each of the new elements, neptunium and plutonium, has two isotopes whose atomic weights are 238 and 239.

13. Different elements, quite distinct in chemical behavior, may have the same atomic weight. We have $_{92}$U-238, $_{93}$Np-238 and $_{94}$Pu-238, all with different properties. Such elements are now called ISOBARS.

14. All atoms are composed of standard interchangeable parts. These are PROTONS, NEUTRONS and ELECTRONS.

15. Protons and neutrons make up the NUCLEUS of the atom. The structure of the atom is much like that of the solar system. The nucleus corresponds to the sun at the center. The planets are electrons.

16. The proton and the neutron each have a mass about equal to that of a hydrogen atom, which is 1 on the chemist's scale. Each is about 1800 times heavier than the electron.

17. The ELECTRONS, light in weight and some distance away from the heart or nucleus of the atom, revolve around the nucleus much as planets revolve around the sun. They are held in their courses by electric attraction.

18. The proton has a POSITIVE charge of electricity, the electron has a NEGATIVE charge equal and opposite to the positive charge of the proton. The neutron has no charge at all.

19. The difference in chemical properties of the elements is caused by difference in the number of protons in the nucleus. This is the ATOMIC NUMBER.

20. Atomic weight is the SUM of the weights of the protons and neutrons in the nucleus.

21. It is the NEUTRON which figures in the transmutations which give atomic power. Neptunium and plutonium were formed by bombarding uranium 238 with neutrons.

22. Neutrons can PENETRATE to the nucleus of heavy atoms when charged particles would be repelled by charges in the atom.

23. The HYDROGEN atom is believed to have just one proton as its nucleus, with one electron circling around it. Hydrogen's atomic weight and atomic number are each one.

24. Hydrogen has one isotope which is just like ordinary hydrogen except that it is twice as heavy. It is known as "heavy hydrogen" and sometimes as DEUTERIUM. Its compound with oxygen is called "heavy water."

25. The nucleus of HEAVY HYDROGEN contains one proton and one neutron. The atomic number of heavy hydrogen is one, corresponding to one proton. The atomic weight is two, corresponding to the two heavy particles, proton and neutron.

26. HELIUM has two protons and two neutrons in its nucleus. The two protons correspond to helium's atomic number two. The combined weights of protons and neutrons in the nucleus give helium its atomic weight 4. Two electrons, held in their orbits by the two protons, revolve around the nucleus.

27. The VOLUME of an atom is determined by the orbits of its outermost revolving electrons. Only a small fraction of the size of an atom is actually occupied by the protons, neutrons and electrons, just as the space occupied by the sun, the earth and other planets is only a small part of our solar system.

28. In spite of all the unoccupied SPACE, an atom is quite IMPENETRABLE to other atoms and to larger bodies. The electrons revolve millions of times a second, and keep everything out of the space within quite as effectively as though they were everywhere at once.

29. The only things that can get inside an atom are smaller things, FRAGMENTS of other atoms, protons, neutrons or electrons. They must be shot with just the right speed. These fragments of atoms are observed as radiations given off by radio-active elements which are breaking up spontaneously.

30. RADIATION is wave motion, known to us as the electro-magnetic waves used for radio transmission, heat, light, X-rays and cosmic rays. Large numbers of extremely tiny particles in motion together act like waves.

31. Three types of radiation are given off by radio-active substances. ALPHA particles are high-speed nuclei of helium atoms. BETA particles are high-speed electrons. GAMMA rays are electro-magnetic radiations similar to X-rays and light.

32. Of these, only the gamma rays are properly called radiations, and even these act very much like particles because of their short wave-length. Such a "particle" or quantum of gamma radiation is called a PHOTON.

33. In general, the gamma rays are very penetrating, the alpha and beta rays less so. Even though the alpha and beta rays are not very penetrating, they have enormous SPEED.

34. The speed with which atom particles travel is the source of atomic energy. ENERGY is capacity to do work. It is work stored up for future use.

35. If you raise a weight to a height above the ground and suspend it there by some device, the WORK you put into raising it can be stored there indefinitely as POTENTIAL ENERGY. It will be there, ready, whenever you decide to release it.

36. The energy which a moving body has because it is in motion is called KINETIC ENERGY. The kinetic energy of any particle depends upon its mass and the square of its velocity. Energy is conserved by the moving particle until it strikes an object, then work is done.

37. All ENERGY is either potential or kinetic. Either one can be converted into the other. These two conversions are continually occurring.

38. Particles of atomic size have kinetic energy arising from several different kinds of MOTION. All atoms are constantly in motion.

39. If the atoms are so dispersed that the material constituting them is a GAS, that gas will exert pressure on all sides of the container that holds it. If the container is a balloon bag, the imprisoned gas can do work by lifting heavy weights into the air.

40. Atoms which compose an element that will combine readily with another element, as hydrogen or carbon will combine with oxygen, have unsymmetrical arrangements of the outer electrons in their systems. These unsymmetrical arrangements tend to set up a sort of strain, which causes CHEMICAL COMBINATION to take place when elements with suitable combining powers are brought together.

41. These unsymmetrical arrangements give rise to FORCES which result in kinetic energy. This energy appears, for example, when carbon and oxygen burn to carbon dioxide, giving off heat, or hydrogen and oxygen explode to form water, again giving off heat.

42. Chemicals combining to form stable compounds give off energy in the process. These are known as EXOTHERMIC REACTIONS. Combinations which absorb energy, forming unstable compounds, are known as ENDOTHERMIC REACTIONS. Explosives, for example, which are highly unstable, are formed by endothermic reactions.

43. Chemical forces, electricity and heat are all forms of energy. Potential and kinetic energy may be distinguished in each case.

44. These energies all arise from motion of the atom as a whole, or motion resulting from attractions and repulsions between the outer PLANETARY ELECTRONS of the atom's structure.

45. Energy resulting from motion of particles deep within the structure of the atom was unknown until the discovery of RADIOACTIVITY.

46. Radioactive elements undergo SPONTANEOUS breaking up of their atoms, giving off alpha and beta particles and gamma rays. Loss of these particles causes the radio-active elements to change into other elements.

Laws of Matter Up-to-Date

Continued from previous page

47. The energies shown in these TRANSFORMATIONS are thousands of times greater than the kinetic energies which the molecules of a gas have by reason of their motion when heated. They are thousands of times greater than the energy changes per atom in chemical reactions.

48. The property of matter that connects it with motion is INERTIA. Inertia is opposition to change of motion.

49. One conclusion that appeared early in the development of the theory of RELATIVITY was that the mass due to inertia of a moving body increases as its speed is increased.

50. This increase implied an equivalence between an increase in energy of motion of a body (kinetic energy) and an increase in its MASS.

51. It was for this reason that Einstein suggested that studies of radioactivity might show the EQUIVALENCE of mass and energy.

52. Einstein's statement is that the amount of energy, E, equivalent to a mass, m, is given by the equation $E=mc^2$ where c is the VELOCITY OF LIGHT.

53. From this equation, one kilogram (2.2 pounds) of matter, if converted ENTIRELY into energy, would give 25 billion kilowatt hours of energy. This is equal to the energy that would be generated by the total electric power industry in the United States (as of 1939) running for approximately two months.

54. Compare this fantastic figure with the 8.5 kilowatt hours of heat energy which may be produced by BURNING an equal amount of coal.

55. Until the atomic power research program, no instance was known of matter being converted into energy without more energy being used to produce the transformation than was released by it.

56. Two axioms of physics stated: (1) MATTER can be neither created nor destroyed; (2) ENERGY can be neither created nor destroyed. For all practical purposes they were true and separate principles until about 1940.

57. It is now known that they are, in fact, two phases of a single principle, for we have discovered that energy may sometimes be CONVERTED into matter and matter into energy.

58. Such conversion is observed in the phenomenon of nuclear FISSION of uranium, a process in which atomic nuclei split into fragments with the release of an enormous amount of energy.

59. The extreme size of the CONVERSION FACTOR explains why the equivalence of mass and energy is never observed in ordinary chemical combustion.

60. We now believe that the heat given off in such COMBUSTION has mass associated with it, but this mass is so small that it cannot be detected by the most sensitive balances available.

61. Transformation of matter into energy is an entirely different sort of phenomenon than the usual chemical transformations, where the matter is changed into a different form but its MASS persists.

62. From the standpoint of the Laws of the Conservation of Matter and of Energy alone, transformation of matter into energy results in the DESTRUCTION of matter and CREATION of energy.

63. The OPPOSITE transformation, which astronomers believe may be going on in some of the stars, amounts to the destruction of energy and the creation of matter.

64. It is difficult for us to imagine the reconciliation of two such different concepts as matter, with its characteristic mass or weight, and energy, which does not have this quality. We shall, perhaps, be forced to think of the stuff of the universe as some such combination of matter and energy as would be symbolized by the coined word "MATTERGY."

Science News Letter, October 6, 1945

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Question Box

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